IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent Application of

ALLENSON et al — Atty. Ref.: 124-749

Serial No. 09/445,991 — Group: 2828

Filed: December 17, 1999 — Examiner: C. Jackson

For: A LIGHT EMITTING DEVICE AND TRANSISTOR

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APPEAL BRIEF

On Appeal From Group Art Unit 2828

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February 23, 2004

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APPEAL BRIEF

Sir:

I. REAL PARTY IN INTEREST

The real party in interest in the above-identified appeal is QinetiQ Limited, by virtue of the Assignment from The Secretary of State for Defence recorded February 20, 2002, at Reel 012831, Frame 0459, and an Assignment from the inventors to The Secretary of State for Defence recorded December 17, 1999, at Reel 10544, Frame 0141.

II. RELATED APPEALS AND INTERFERENCES

There was a prior appeal noted in this application and, after review of the appeal brief, a new final rejection was mailed by the PTO, from which the current appeal was taken.

III. STATUS OF CLAIMS

Claims 1 and 3-18 stand rejected in the final Official Action. The Examiner contends that claims 1 and 3-18 indefinite under 35 USC §112 (2nd ¶) and are obvious under 35 USC §103 in view of the cited prior art.

IV. STATUS OF AMENDMENTS

No further response has been submitted with respect to the final Official Action in this application.

V. SUMMARY OF THE INVENTION

The present invention relates to a laser device which operates with enhanced quantum efficiency across a broad band of modulation frequencies.

Typically fiber optic links are utilized to prevent feedback between input and output circuits of high frequency devices. Typically in systems relating to fiber optic communications and optical distribution of radio frequency, microwave, mm-wave and digital signals in electronic systems such as phased

array radars, a fiber optic link is utilized to insulate an input circuit from an output circuit in order to prevent feedback from the output circuit affecting the input circuit. Typically such fiber optic links operate at an upper frequency limit of around 10 GHz which is set by the response capability of the laser to the input signal.

Conventional fiber optic links cannot deliver signal gain unless either electronic or optical amplifiers are included in the signal path. Additionally, for use in fixed impedance environments such as microwave circuits, a relatively narrow band impedance transformation is needed to match the low impedance laser in order to minimize signal loss (it will be recalled that impedance mis-match between transmitter and antenna results in a substantial reflected power.

Appellants found that an extremely efficient light emitting device could be provided by utilizing at least two light emitters, in which each of the light emitting devices had its own optical waveguide, impedance and quantum efficiency. Appellants found that by connecting the light emitters in series, the input impedance of the device is equal to the sum of the impedances of the light emitting means, and thus impedance could be matched, thereby preventing the adverse consequences of reflected power. Moreover, it was also found that the quantum efficiency of the overall device is substantially equal to the sum of the quantum efficiencies of the individual light emitting means which were arranged

optically so that the light emitting means do not share a common optical waveguide.

In view of the above discovery, the device has been successfully used in an isolation system for converting an electrical signal into an optical signal and then outputting an output electrical signal. Applications also include use as an optical repeater and also with respect to the division of an RF signal, into a number a fiber optic channels.

In view of the above, the present light emitting device is characterized by at least two **"light emitting means for converting the input current of electrons into a beam of output radiation"**, each "having a respective optical waveguide and having an impedance and an individual quantum efficiency" with the at least two light emitting means "**electrically connected in series such that the input impedance of the light emitting device is substantially equal to the sum of the impedances of the light emitting means**." Moreover, the quantum efficiency of the device is "substantially equal to the sum of the quantum efficiencies of the light emitting means" and specifically the "**light emitting means do not share a common optical waveguide**."

VI. ISSUES

Whether claims 1 and 3-18 are indefinite under 35 USC §112 (2nd ¶).

Whether claims 1 and 3-18 are obvious under 35 USC §103 over Edwards (WO96/08557) in view of Kushibe (U.S. Patent 4,928,285).

Whether claims 12 &13 are obvious under 35 USC §103 over the Edwards/Kushibe combination, in view of Rossi (U.S. Patent 5,799,029) and/or Hsu (U.S. Patent 5,317,440).

VII. GROUPING OF CLAIMS

The rejected claims stand or fall together as described in the argument portion of this Appeal Brief.

VIII. ARGUMENT

1. Discussion of the References

The Examiner's abandonment of reliance upon the Tucker (U.S. Patent 5,440,577) and Ito (U.S. Patent 5,130,531) references which were distinguished in the previously submitted Appeal Brief is appreciated. However, the Examiner adds newly cited Rossi (U.S. Patent 5,799,029) in the most recent final rejection.

Edwards (WO 96/08857) teaches a photon coupled circuit comprising semiconductor light emitting diodes in which the diodes are linked in series. However, as the Examiner admits, Edwards fails to teach "the light emitting means have a respective optical waveguide and are arranged optically such that the light emitting means do not share a common optical waveguide." Moreover, there

does not appear to be any teaching in Edwards of the specific "light emitting means" described in appellants' specification or equivalents thereof. Therefore, Edwards not only fails to disclose appellants' claimed "light emitting means," but also fails to teach the light emitting means with the respective optical waveguides and that those waveguides are optically arranged so that the light emitting means do not share a common optical waveguide.

Edwards also specifically requires light emitting diodes of the highest possible efficiency (page 13, line 25 to page 14, line 2) thereby leading one of ordinary skill in the art to utilize LEDs of the highest efficiency, even if they provide multi-mode output.

Kushibe et al (U.S. Patent 4,928,285) teaches a single impurity-doped semiconductor linked to a waveguide. Kushibe teaches the benefit of single mode operation achieved by the addition of certain impurities into the laser structure. Kushibe would lead one of ordinary skill in the art towards a single mode output rather than a multimode output.

Kushibe does not teach that a plurality of his devices could be interconnected so that they are electrically connected in series, or that with such connection the impedance of the overall device is the sum of the impedances of the individual light emitters, or that the quantum efficiency of the overall device is equal to the sum of the quantum efficiencies of the individual devices.

Rossi (U.S. Patent 5,799,029) teaches a laser system for providing high power and stable light intensity. The Examiner suggests that Rossi teaches the use of optical fiber for transmitting the beams of output radiation. However, the Rossi reference teaches a stack of LED lasers in Figures 1 and 2 for providing a broad output and then utilizing lenses and/or a single optical fiber 42 which conveys the output from the plurality of light emitting diodes.

Rossi in teaching that a plurality of LEDs supply a common optical waveguide would lead one of ordinary skill in the art away from appellants' claim in which the light emitting means do not share a common optical waveguide.

Hsu (U.S. Patent 5,317,440) teaches a single wavelength bidirection optical fiber communication link for use in remotely controlling systems.

There is no disclosure of a light emitting device which comprises at least two light emitters with separate optical waveguides and instead relies upon a single emitter and a single waveguide. There is no disclosure, of course, that a plurality of light emitters could be connected in series so that the impedance of the device is equal to the sum of the individual impedances or that the quantum efficiency of the device is equal to the sum of the individual quantum efficiencies.

2. Discussion of the Rejections

Claims 1 and 3-18 stand rejected under 35 USC §112 (2nd ¶) with the Examiner stating that the claim is defective for "failing to particularly point out

and distinctly claim how 'at least two light emitting means convert the input current of the electrons into a single beam of output radiation'."

Claims 1 and 3-18 stand rejected under 35 USC §103 as unpatentable over Edwards in view of Kushibe. To the extent the rejection is understood, the Examiner, while admitting that Edwards "fails to teach the light emitting element means have a respective optical waveguide and are arranged optically such that the light emitting means do not share a common optical waveguide" suggests that this and the other claimed features are shown in the Kushibe reference. The Examiner fails to point out how or where there is any motivation for combining the Edwards and Kushibe references.

Claims 12 and 13 stand rejected under 35 USC §103 as unpatentable over the Edwards/Kushibe combination further in view of Rossi and/or Hsu. The Examiner admits that the Edwards/Kushibe combination fails to teach "the use of optical fiber for transmitting the beams of output radiation." Again, to the extent it is understood, the Examiner cites Rossi and/or Hsu only for the teaching of optical fibers for transmitting beams of output radiation but apparently fails to realize that these references teach that a single optical fiber which is fed by the multiple light emitting diodes. The Examiner fails to mention any reason or motivation for combining the Edwards/Kushibe/Rossi and/or Hsu disclosures in the manner of appellants' claims.

3. The Errors in the Final Rejection

There are at least five significant errors in the Final Rejection and they are summarized as follows:

(a) 35 USC §112(6th ¶) requires the "light emitting means" portion of independent claims 1 & 18 to mean the corresponding structure set out in appellants specification;

(b) No prior art references teach a "light emitting means for converting" let alone the claimed two light emitting means as described in the corresponding portion of the appellants specification;

(c) The Examiner has revealed no reason or motivation for combining the references;

(d) The Rossi and Hsu references teach using a plurality of LED to feed a single optical fiber; and

(e) The Edwards and Kushibe references teach away from the claimed invention.

(a) 35 USC §112(6th ¶) requires the "light emitting means" portion of independent claims 1 & 18 to mean the corresponding structure set out in appellants specification

35 USC §112(6th ¶) requires that a "means" claim be construed to cover the corresponding structure in the specification and equivalents thereto. The Examiner has repeatedly failed to properly construe the "light emitting means"

portion of the claims, as pointed out in the previous amendment (filed July 11, 2003, page 9).

A review of the corresponding portion of appellants' specification discloses that in Figure 1 appellants disclose at least two light emitting diodes where each diode has a separate waveguide layer 5. Thus, the "light emitting means" recited in appellants' independent claims must be construed to cover a light emitting diode in which it has a separate waveguide layer which is separate and apart from any other light emitting diode.

The fact that appellants' claim also specifies that there are "at least two" such diodes does not relieve the Examiner from the requirement of properly construing each of the independent claims. The Examiner's failure to properly construe claim 1 renders any opinion with respect to independent claims 1 and 18 improper and violative of 35 USC §112 (sixth paragraph). Accordingly, reversal on this single basis is respectfully requested.

Moreover, or perhaps as a result of his failure to properly construe the claims, the Examiner argues that claims 1 and 18 are indefinite. The Examiner believes the claims to be indefinite because he requires the claim to disclose "how" the light emitting means convert the input current into "a single beam of output radiation." [The quotation is in the Examiner's Official Action, but is not present in appellants' claims]. As noted above, when claims 1 and 18 are properly construed in accordance with appellants' specification (pursuant to the

requirements of 35 USC §112 (sixth paragraph)), they require that each individual light emitting structure provides output radiation into a single waveguide. How or where the Examiner believes there to be any disclosure of a structure in appellants' specification which requires two light emitting structures to provide radiation into a single waveguide is not seen or understood.

In view of the above, the Examiner has failed to properly construe claims 1 and 18 and the rejection of these claims and claims dependent thereon under 35 USC §112 (second paragraph) is without support. By definition, a "means-plus-function" claim limitation is supported by the corresponding structure set forth in appellants' specification. The Examiner in his rejection fails to properly construe the claims and as a result clearly misses the fact that each of these claims is properly disclosed in appellant's specification by definition.

(b) No prior art references teach a "light emitting means for converting" let alone the claimed two light emitting means as described in the corresponding portion of the appellants specification

When properly construed as required by 35 USC §112 (sixth paragraph), none of the prior art references teach appellants' claimed light emitting means. The Examiner admits that Edwards fails to teach appellants' claimed light emitting means. Clearly Rossi teaches that a single fiber is to be fed with multiple light emitting diodes and therefore fails to teach the claimed structure. The Kushibe

and Hsu references teaches only single light emitting structures feeding single optical waveguides.

As a result, because no reference teaches a plurality of light emitters when claims 1 and 18 are properly construed, where the light emitters feed separate optical waveguides, there is no support for any rejection of claims 1 and 18 or the claims dependent thereon.

(c) The Examiner has revealed no reason or motivation for combining the references

The Court of Appeals for the Federal Circuit has held in the case of In re Rouffet, 47 USPQ2d 1453, 1457-8 (Fed. Cir. 1998) that

> "To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court **requires** the examiner to show a motivation to combine the references that create the case of obviousness. In other words, **the Examiner must show reasons** that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." (Emphasis added).

Neither the Edwards nor Kushibe reference contain any reason which would motivate one of ordinary skill in the art to combine portions of their respective teachings. Neither reference is directed towards the problem solved by appellants' claimed invention, i.e. impedance matching between input and output circuits and providing a plurality of beams of output radiation. Because neither Edwards nor Kushibe deal with the problem solved by the present invention, one

of ordinary skill in the art would have no reason to pick and choose elements from the two references in an attempt to meet appellants' claim.

The Court of Appeals for the Federal Circuit has also confirmed that "[t]he PTO has the burden under §103 to establish a *prima facie* case of obviousness." *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). The Examiner has failed to meet his burden of establishing a "motivation to combine" or "reasons . . . [to] select the elements" of the prior art references in the manner claimed. As a result, there is simply no basis for a rejection under 35 USC §103.

(d) The Rossi and Hsu references teach using a plurality of LED to feed a single optical fiber

The Court of Appeals for the Federal Circuit has also confirmed that it is "error to find obviousness where references 'diverge from and teach away from the invention at hand'." *In re Fine*, 5 USPQ2d 1596, 1599 (Fed. Cir. 1988).

As noted above, the Rossi reference specifically discloses a plurality of light emitting diodes feeding a single optical fiber 42. Thus, Rossi clearly teaches away from a light emitter feeding its own separate optical fiber waveguide as set out in appellants' independent claims 1 and 18. As noted above, Hsu teaches only a single light emitter and a single waveguide and therefore similarly teaches away from a plurality of emitters, each feeding a separate waveguide.

Because the Rossi and Hsu references teach away from appellants' claimed structure of having at least two emitters and each of the emitters supplying a

separate optical waveguide, neither Rossi nor Hsu teaches appellants' claimed combination and indeed would lead one of ordinary skill in the art away from appellants' claimed combination. Any further rejection of independent claims 1 and 18 over the Rossi and/or Hsu references is respectfully traversed.

(e) The Edwards and Kushibe references teach away from the claimed invention

The Edwards patent teaches that a plurality of light emitters should be connected to a single common waveguide. There is no teaching or disclosure that the individual light emitters could be connected to separate waveguides, and indeed the benefit in Edwards is in connecting them to a single waveguide. The Kushibe reference teaches the provision of a single laser device connected to a single waveguide for light emitted from that laser. It is unrelated to any problem of impedance matching or improved quantum efficiency, etc.

As a result, both Edwards and Kushibe teach away from a plurality of emitters, each having a respective waveguide, and the other interrelationships of appellants' independent claim 1. Accordingly, the combination of Edwards and Kushibe cannot render obvious appellants' claim 1 and claims dependent thereon, because each of Edwards and Kushibe would lead one of ordinary skill in the art away from appellants' invention, with Edwards suggesting multiple light emitters feeding a single waveguide and Kushibe teaching only a single waveguide with a single light emitter. Accordingly, the rejection under 35 USC §103 must fail.

IX. CONCLUSION

The Examiner has improperly rejected independent claims 1 and 18 under 35 USC §112 (second paragraph) as being indefinite. However, the source of the indefiniteness is the fact that the Examiner has failed to construe the claims as required under the sixth paragraph of §112. Properly construed claims 1 & 18 are clearly definite under the second paragraph of §112. Appellants have noted that no prior art reference teaches appellants' claimed "light emitting means," let alone the specifics of the light emitting means which are disclosed in appellants' specification.

The Examiner has failed to provide any reason or motivation for combining any of the references and thus has failed to establish a *prima facie* case of obviousness. Finally, all of the Rossi, Hsu, Edwards and Kushibe references separately and together would lead one of ordinary skill in the art away from appellants' combination of elements. Accordingly, there is simply no basis for any rejection of claims 1-18 in the present application or claims dependent therefrom.

Thus, and in view of the above, the rejections of claims 1 and 3-18 over the cited prior art is clearly in error and reversal thereof by this Honorable Board is respectfully requested.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____

Stanley C. Spooner
Reg. No. 27,393

SCS:kmm
Enclosures
Appendix A - Claims on Appeal

APPENDIX A

Claims on Appeal

1. A light emitting device, having an input impedance and a device quantum efficiency, for generating at least two beams of output radiation from an input current of electrons comprising:

at least two light emitting means for converting the input current of electrons into a beam of output radiation, each of the light emitting means having a respective optical waveguide and having an impedance and an individual quantum efficiency,

wherein the light emitting means (i) are electrically connected in series such that the input impedance of the light emitting device is substantially equal to the sum of the impedances of the light emitting means and such that the quantum efficiency of the device is substantially equal to the sum of the quantum efficiencies of the light emitting means and (ii) are arranged optically such that the light emitting means do not share a common optical waveguide.

3. The light emitting device of Claim 1, wherein the light emitting means are electrically connected such that the input impedance of the light emitting device is substantially equal to 50 Ω without additional circuitry or impedance matching elements.

4. The light emitting device of Claim 3, wherein each of the light emitting means have a modulation frequency limit and wherein the input impedance of the light emitting

device is substantially equal to 50 Ω across a frequency range substantially from DC to the modulation frequency limit of each of the light emitting means.

5. The light emitting device of Claim 1 wherein the light emitting means are p-n junctions.

6. The light emitting device of Claim 5, wherein the p-n junctions are laser diodes or light emitting diodes.

7. The light emitting device of claim 6, wherein the laser diode devices may be any one of AlGaAs, AlGaInP, AlGaInAs or AlGaInAsP laser diode devices.

8. The light emitting device of Claim 6, wherein the p-n junctions each have an end face coated with a reflective coating.

9. An optically coupled transistor for generating an output electrical signal comprising;

the light emitting device of Claim 1 for emitting at least two beams of output radiation and

at least one photodetector for detecting the beams of radiation output from the light emitting device and for converting the beams of output radiation into an output electrical current,

wherein the light emitting device and the at least one photodetector are arranged such that there is no electrical feedback from the at least one photodetector to the light emitting device.

10. The optically coupled transistor of Claim 9 wherein the one or more photodetector is a photodiode device.

11. The optically coupled transistor of Claim 9, comprising at least two photodetectors, wherein the photodetectors are connected in any one of a series connection, a parallel connection or a series parallel connection.

12. The optically coupled transistor of Claim 9, comprising one or more optical fibres for transmitting the beams of output radiation to the one or more photodetectors.

13. A fibre optic link comprising one or more optical fibres having an input endface and an output endface, and also comprising the light emitting device of Claim 1,

wherein the light emitting device is situated at the input endface of one or more optical fibres such that the beams of radiation output from the light emitting device are input to the one or more optical fibres.

14. A method for distributing an input signal into an output channel comprising the steps of;

(i) outputting two or more beams of radiation from the light emitting device of Claim 1 comprising at least two light emitting means and

(ii) inputting the two or more beams of output radiation into the output channel,

whereby the light emitting means are connected such that the device quantum efficiency is greater than or equal to the individual quantum efficiency of one of the light emitting means.

15. A method for distributing an input signal into a plurality of output channels comprising the steps of;

(i) outputting two or more beams of radiation from the light emitting device of Claim 1 comprising at least two light emitting means and

(ii) inputting each of the two or more beams of output radiation into a different one of the output channels,

whereby the light emitting means are connected such that the device quantum efficiency is greater than or equal to the individual quantum efficiency of one of the light emitting means.

16. An optical repeater for receiving an optical input signal and generating one or more optical output signals comprising;

a photodetector for receiving the optical input signal and converting the optical input signal into an electrical signal and

the light emitting device of Claim 1 for receiving the said electrical signal and outputting one or more optical signals.

17. The optical repeater of Claim 16 and also comprising amplification means for amplifying the electrical signal output from the photodetector.

18. A light emitting device, having an input impedance and a device quantum efficiency, for generating at least two beams of output radiation from an input current of electrons comprising:

at least two light emitting apparatuses, each light emitting apparatus comprising at least one light emitting means for converting the input current of electrons into a beam of output radiation, each light emitting means having a respective optical waveguide and having an impedance and an individual quantum efficiency, and at least one of said at least two light emitting apparatuses comprises at least two light emitting means electrically connected in parallel;

wherein the at least two light emitting apparatuses are electrically connected in series such that the input impedance of the light emitting device is substantially equal to the sum of the impedances of the at least two light emitting apparatuses and the quantum efficiency of the device is substantially equal to the sum of the quantum efficiencies of the light emitting means and

wherein the at least two light emitting apparatuses are arranged optically such that the light from one of the light emitting means is not transmitted to another of the light emitting means.

Image

AF/2828

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Sir:

☐ **Correspondence Address Indication Form Attached.**

☐	**NOTICE OF APPEAL** Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the Examiner. ($ 330.00)	$	
☒	An appeal **BRIEF** is attached in triplicate in the pending appeal of the above-identified application ($ 330.00)	$	330.00
☒	Credit for fees paid in prior appeal without decision on merits	-$ (	320.00)
☐	A reply brief is attached in triplicate under Rule 193(b)		**(no fee)**
☐	Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s) **($110.00/1 month**; $420.00/2 months; **$950.00/3 months**; $1480.00/4 months)	$	
	SUBTOTAL	$	10.00
☐	Applicant claims "Small entity" status, enter ½ of subtotal and subtract ☐ "Small entity" statement attached.	-$(	)
	SUBTOTAL	$	10.00
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	TOTAL FEE ENCLOSED	$	10.00

Any future submission requiring an extension of time is hereby stated to include a petition for such time extension. The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our **Account No. 14-1140.** A duplicate copy of this sheet is attached.

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